



Transportation Synthesis Report

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Forecasting Useful Life Of Pavement Markings and Sign Coatings

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Bureau of Highway Operations
Division of Transportation Systems Development

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Transportation Synthesis Reports (TSRs) are brief summaries of currently available information on topics of interest to WisDOT technical staff in highway development, construction and operations. Online and print sources include NCHRP and other TRB programs, AASHTO, the research and practices of other state DOTs, and related academic and industry research. Internet hyperlinks in TSRs are active at the time of publication, but changes on the host server can make them obsolete.

Request for Report

WisDOT is interested in gathering objective information on the expected life of highway pavement marking materials and traffic sign coatings in order to project maintenance costs as accurately as possible. Of particular interest is research that identifies material deterioration rates over time, factoring in such variables as sign direction, precipitation, temperature, wind and average daily traffic volume. RD&T was asked to review available research and practices that might be useful to the department's Bureau of Highway Operations.

Summary

Research and test data on pavement marking and sign coating materials is available in several forms, much of it only on a product-by-product basis. The NCHRP Synthesis 306 on Long Term Pavement Marking Practices and the Utah study contain good information on broad categories of pavement marking materials, application methods and costs, and traffic and climate conditions; but there doesn't appear to be a similar resource for sign coating materials. AASHTO's National Product Evaluation Program (NTPEP) and Product Evaluation Listing (APEL) provide good data on both pavement marking materials and sign coatings. Test results for a variety of parameters can be graphed or exported to Excel.

Pavement Marking Materials

NCHRP

Synthesis Report 306: Long Term Pavement Marking Practices, NCHRP Project 20-5, Topic 31-07, 2002.
<http://trb.org/news/blurbs/detail.asp?id=1119>

This synthesis report contains a good summary of elements to be considered when making pavement-marking decisions, along with specific research results. The report includes:

- Definition of terms used
- Discussion of methods used to determine useful life of materials
- Requirements and measurement of retroreflectivity
- Crash data relative to pavement markings
- Specifications, practices and materials
- Environmental considerations
- Performance evaluations by type of material and application method

For example, chapter three includes discussion and tables to establish minimum needs for retroreflectivity, wet night retroreflectivity, and impact on budgets. These and other factors influence maintenance schedules for pavement markings.

Page 13: “Generally, the ability of a driver to operate a vehicle safely is based on the perception of a situation, level of alertness, the amount of information available, and the ability to assimilate the available information. The ideal form of delineation is that which provides the most guidance and warning to the driver.”

Page 15: Table 2 shows retroreflectivity needs relative to driving speed.

Page 16: FHWA guidelines for minimum retroreflectivity are in Table 4.

Page 17: “the threshold retroreflectivity values presented in Table 6 were used in FHWA research to evaluate the impact on state agency pavement marking budgets, determine the retroreflective requirements under wet night conditions, and define the end of pavement-marking service life.”

Page 19: Table 8 provides estimated comparisons of pavement marking budgets using different criteria for replacement schedules.

Chapter seven discussions include environmental factors and regulations, service life of various materials, traffic delays and cost comparisons.

Page 56: “Longitudinal and word and symbol markings can reach the end of service life either because of bead loss resulting in poor retroreflectivity, loss of the base material because of chipping and abrasion, or color change or the loss of contrast of the base material of the marking.” Table 33 provides detail on the service life of different types of products.

Page 63: “Delay to traffic when roads are being marked under traffic is another cost to be added to that for obtaining and placing markings. Traffic is delayed because a striping convoy moves much more slowly than normal traffic. In addition, a striping convoy will be spread out and at times and under some circumstances, for example, on a two-lane highway, traffic may not be able to pass.” Table 40 provides an estimate of the relative costs of traffic delays.

Page 64: Since application of pavement markings may be accomplished by different entities, Table 42 compares the costs of pavement marking application when performed by transportation agencies or contractors.

UTAH

A Comparative Analysis of the Alternative Pavement Marking Materials for the State of Utah, August 1996.

<http://www.trafficlab.utah.edu/research/projects/current/acrobat/UDOTfin.pdf>

From the analysis: “As Utah’s population increases, the Utah Department of Transportation (UDOT) has been saddled with increasing traffic levels and the need to re-apply pavement markings more frequently. In order to minimize costs for pavement markings, relationships between pavement marking life expectancy and traffic levels were developed.”

This study appears to be a good source for both data and methods. It includes numerous graphs showing the useful life of varying materials, along with cost comparison charts. Charts include application costs as well as product costs. Formulas for determining costs are given to allow current pricing to be evaluated.

For example, the charts on pages 12 through 18 show the life expectancy of different marking materials on both asphalt and Portland cement concrete pavements with different traffic volumes and varying snow conditions. Formulas are given for calculating deterioration rates on page 42, and for useful life and costs on page 45, while conclusions on the relative merits of product types are drawn on page 56. These formulas and methods should remain useful in producing budget projections considering current costs of the various pavement marking materials and current application costs.

AASHTO NTPEP DataMine

National Transportation Product Evaluation Program: Pavement Marking Materials, 2002

<http://data.ntpep.org/pmm/pmm.asp>

This site is a good data source, with references to a large number of pavement marking materials. Products can be investigated by manufacturer, type, color or retroreflectivity. Reports on individual materials are organized by test deck and the site has the capability of creating color graphs to allow visual clarity of performance of various marking materials relative to required specifications. For detailed analysis, select data can be downloaded in a spreadsheet format.

AASHTO Product Evaluation List

<http://apel.transportation.org/programs/apel/site.nsf/homepage/overview?opendocument>

A good source for specific product evaluations. Searches can be refined by selecting the manufacturer, product or evaluation buttons on the search screen. Some results also include contacts at the evaluating entity, including phone numbers and/or email addresses.

Sign Coating Materials

AASHTO NTPEP DataMine

National Transportation Product Evaluation Program: Sign Sheeting Materials, 2002.

<http://data.ntpep.org/ssm/ssm.asp>

A good data source. Searchable by color, component used, reflectivity and specific field properties, as well as by manufacturer. Reports are available by specific test deck, allowing searches to be narrowed to fit regional climate and road conditions. Color graphs of useful life can be created using specific properties such as luminance factor, reflectivity and color. Weather graphs of the test areas provide comparisons with local conditions. For detailed analysis, select data can be downloaded in a spreadsheet format.

AASHTO NTPEP

Project Work Plan for the Field and Laboratory Evaluation of Sign Sheeting Material, May 15, 2002.

[http://www.transportation.org/programs/ntpep/home.nsf/f506011754de84cd86256840000a07d1/9b1834b6d90c6b2a86256cb40061f9c7/\\$FILE/SSM_Project_Work_Plan-2003_Rev.pdf](http://www.transportation.org/programs/ntpep/home.nsf/f506011754de84cd86256840000a07d1/9b1834b6d90c6b2a86256cb40061f9c7/$FILE/SSM_Project_Work_Plan-2003_Rev.pdf)

This document details sign sheeting test procedures. It includes production of the sign samples and application methods for the sheeting, along with descriptions of the tests run on each sign, such as measures of retroreflectivity and locations of the test decks.

AASHTO NTPEP Home: Sign Sheeting, Revised January 2005

http://www.transportation.org/programs/ntpep/home.nsf/AllPages/SignSheetingMaterials?OpenDocument#SSM_REPORTS

Includes a brief history of AASHTO's testing, project panel members with telephone numbers, current test decks with climate conditions, and links to other resources such as contact information for policymakers in various states.

AASHTO Product Evaluation List

<http://apel.transportation.org/programs/apel/site.nsf/homepage/overview?opendocument>

A good source for specific product evaluations. Searches can be refined by selecting the manufacturer, product or evaluation buttons on the search screen. Some results also include evaluator contacts, with telephone numbers and/or email addresses.